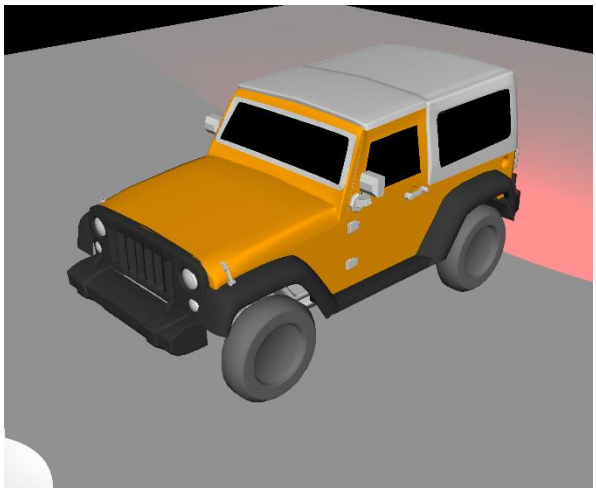
Proseminar Visual Computing
Winter Semester 2021

CG Assignment 3
Hand-out: December 14, 2021
Hand-in: January 11, 2022




Topics

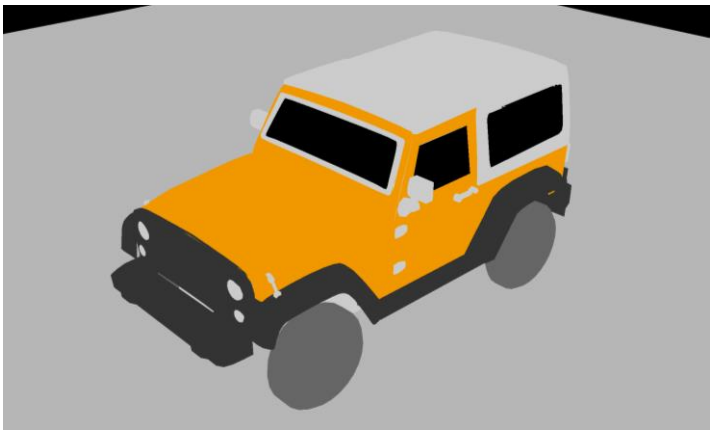
- Lighting and Materials
- Texturing
- Shader Programming

Outline

The goal of the Computer Graphics assignments of the Visual Computing PS is to build an animated car. This work is divided in 3 steps. Each step corresponds to a programming assignment. The objective of this assignment is to implement *Blinn-Phong Illumination* in the *Fragment Shader* in GLSL using material properties encoded in textures.

Template code

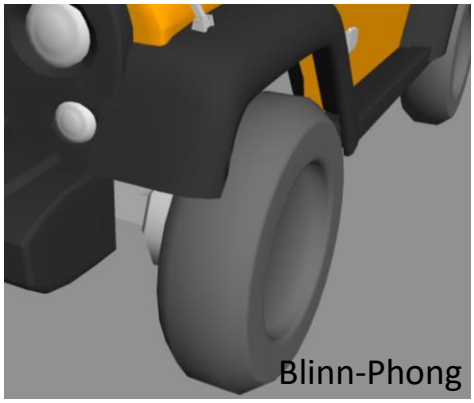
A template code is provided with this assignment. It loads the car mesh, material properties, and textures given by an .obj file. The car controls from the previous assignment are already implemented. Currently, the fragment shader sets the fragment's color according to the diffuse material color.

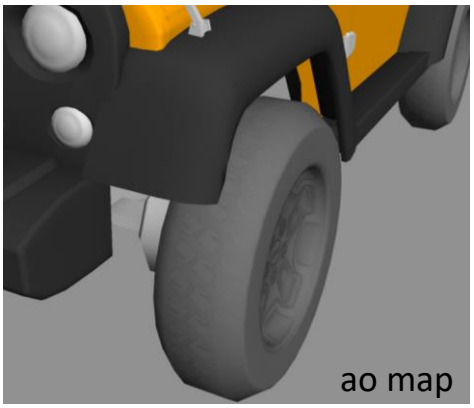


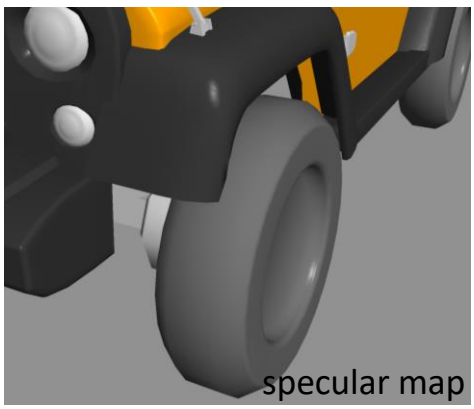
Tasks

1. Implement *Blinn-Phong* illumination in the *Fragment Shader* for a directional light and four spotlights with the material properties (color values and shininess) given in the car model (loaded from an .obj (.mat) file). You should be able to copy paste the code from the previous assignment.

2. Instead of using constant color values for surface materials, use the loaded texture maps (*map_diffuse, map_specular, map_emission, map_ambient_occlussion*) to retrieve these color values for each fragment.
   The value from the ambient occlusion map represents the strength of the ambient light reaching a certain surface position. Use this value to multiply the diffuse material to get the ambient material color.







3. At last, write the names of the group members on the hood of the car, by modifying the diffuse texture of the car body. It should be visible in the rendering of the scene.

Implementation Remarks

Make sure that your code is clear and readable. Write comments when necessary. Your solution should contain a readme file with names of the team members, list of keyboard controls, and any explanation that you think is necessary for the comprehension of the code.

Submission and Grading

Submission of your solution is due on January 11th, 2022 (23:59). **Submit the sources** (i.e., only the content of the *src* folder) in a ZIP archive via OLAT. Do not submit the executable and the content of the *build* folder. Do not submit the external dependencies either. Both folder and archive should be named according to the following convention:

Folder: **CGA2_<lastname1>_<lastname2>_<lastname3>**

Archive: **CGA2_<lastname1>_<lastname2>_<lastname3>.zip**,

where <lastname1>, etc. are the family names of the team members. Development in teams of two or three students is requested. Please respect the academic honor code. In total there are 15 marks achievable in this assignment distributed as follows:

- Blinn-Phong implementation from last assignment (**3 marks**)
- Use textures to map material properties to fragment (**8 marks**)
- Draw names of group members to texture **(2 marks)**
- Code readability, comments, and proper submission: (**2 marks**)

Resources

- Lecture and Proseminar slides as well as code and information are available via OLAT.
- OpenGL homepage
  http://www.opengl.org
- OpenGL 3.3 reference pages
  https://www.khronos.org/registry/OpenGL/specs/gl/glspec33.core.pdf
- OpenGL Tutorial for Blinn-Phong Illumination with textures
  https://learnopengl.com/Lighting/Basic-Lighting
  https://learnopengl.com/Lighting/Lighting-maps
- GL Framework GLFW
  https://www.glfw.org/documentation.html

Note: Be mindful of employed OpenGL and GLSL versions!